

REMARKS ON THE NEMATODE, *GONGYLONEMA PULCHRUM*.

By PROFESSOR T. HARVEY JOHNSTON, M.A., D.Sc., University of Adelaide.

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In February, 1936, a nematode was received for identification from Dr. W. Gilmour, Director of the Pathological Laboratory, Auckland Hospital, together with a statement that it had been taken from the tissue immediately under the inner surface of the upper lip of a Jugo-Slav living in New Zealand. The specimen was submitted by Dr. T. H. Pettit, Auckland, and the circumstances associated with the case are being published in the New Zealand Medical Journal (Johnston, 1936).

The worm proved to be *Gongylonema pulchrum* Molin, 1857, which is normally a parasite of the submucosa of the upper half of the digestive tract of sheep, cattle and pigs, occurring more frequently in the oesophagus in the first and second, and in the tongue region in the pig.

This species seems to have been recorded from human beings on seven previous occasions, the first two from Italy, and the remaining five from the south-eastern portion of the United States.

In 1864, Pane briefly described as *Filaria labialis* an obviously immature female worm taken from a small pustule on the inner surface of the upper lip of a medical student in Naples. The parasite was 30 mm. long, with the vulva and anus situated at 3 and 0.5 mm., respectively, in front of the end of the short club-like tail. Pane's description and main figure were republished by Leuckart (1876, 616-7), who stated that the position of the female aperture was more like that in Strongylidae, though he retained the species under *Filaria* provisionally. Leuckart also drew attention to Leidy's very brief account (1850, 117) of *Filaria hominis oris* from a human lip (? locality), but he regarded the two as distinct, probably correctly. Leidy thought that his parasite may have been the male of *Filaria medinensis*, but some later authors have suggested it may have been a Mermithid. Its dimensions (length, 140 mm.) and the form of the posterior end seem to exclude it from *Gongylonema pulchrum*. A summary of Pane's account was given by Davaine (1877, CVII), Cobbold (1879, 207), Blanchard (1890, 14), Braun (1903, 275; 1906, 305); Parona (1911, 321). Fantham, Stephens and Theobald (1916, 407) gave the same information as Braun but called the parasite *Agamofilaria labialis*; as also did Castellani and Chalmers (1913, 522; 1919, 641). Sambon (1925, 49; 1926, 251) referred to Pane's record, republished his figure and identified the parasite as having been, most probably, *Gongylonema pulchrum*. Yorke and Maplestone (1926, 314) listed it as *G. labiale*, though they remarked that Baylis (1925) regarded it, along with several other species, as a synonym of *G. pulchrum*.

In 1908 Tecce reported taking from a small tumour on the finger of a young man in Italy a female worm 13 cm. long and one millimetre wide. It was handed to Pierantoni, who identified it as *Filaria labialis* Pane and described and figured it (1908). A brief abstract of these two papers was published by Parona (1911, 465 and 367, respectively). I have not seen Pierantoni's account, but it seems unlikely that a parasite of such a length taken from the subcutaneous tissue of a finger would be *Gongylonema pulchrum*. I have, accordingly, refrained from including this record in the number of reported cases of undoubted *Gongylonema* from man. Castellani and Chalmers (1913, 522; 1919, 64) mentioned Pierantoni's reported occurrence of the parasite.

The second record was that by Alessandrini (1914, 42), who reported having examined several worms extracted from tunnels in the submucosa below the tongue of a girl near Rome. He recorded them as belonging to a new species, *Gongylonema subtile*, resembling *G. pulchrum*. He had previously (1908, 163) recognised *G. scutatatum* as occurring in Italian sheep and cattle. Sambon (1925, 69; 1925, 315) referred to Alessandrini's case, and published notes (1926, 254) supplied by Carega, the physician who first drew attention to it. Sambon reported the parasite to be *G. pulchrum*, this identification being due to Baylis (1925, 361), who reported, after examining Alessandrini's specimens, that *G. subtile* was a synonym of *G. pulchrum*.

The next to record the parasite from human beings was Ward (1916), who gave a detailed account of a specimen taken from the lower lip of a girl in Arkansas, U.S.A. He regarded it as being probably *G. pulchrum*, his figures being republished by Brumpt (1922). Ward suggested that *Filaria hominis oris* might possibly have been *G. scutatatum*, but thought it improbable because Leidy was an acute observer who was hardly likely to miss the prominent cuticular bosses which occur anteriorly in species of *Gongylonema*.

It was Stiles who reported the next two cases; one from the lower lip of a woman in Florida (1918, 64; 1920, 200; 1921, 197); and the other from the back of the mouth of a woman in Georgia (1921, 197; 1921, 1,177). The Florida worm was regarded as either *G. pulchrum* or *G. scutatatum*. In the account of the case from Georgia, it was recognised that the parasite resembled *G. pulchrum*, but Stiles thought it advisable to name it as a distinct species, *G. hominis*, until mature specimens of human origin should be available to allow comparison with the worm occurring in the pig. The three North American cases to date were regarded by him as relating to *G. hominis*. Brumpt (1922, 637) placed the latter as a synonym of *G. pulchrum*.

Ransom (1923, 244) made brief reference to the finding of an immature female in the mucosa of the mouth of a man in Louisiana. Stiles and Baker (1929, 221; 1928, 1,891) recorded another case, this time from the mouth of a girl in Virginia, the worm being called *G. hominis* rather than *G. pulchrum* because of the doubt regarding the identification of the species from pigs in U.S.A.. Chapin (1922) had previously described the parasite of North American pigs as a distinct form, *G. ransomi*, though this name was definitely synonymised with *G. pulchrum* by Baylis (1925) and Lucker (1932, 134), the latter having re-examined Chapin's material.

The present case from a man in Auckland, New Zealand, constitutes the eighth recorded from human beings. The worm was a female, 58 mm. long, 0.33 mm. in diameter, and had just reached maturity, since it contained abundant fertilised eggs, while within the vagina was a single egg (0.059 by 0.035 mm.) with a well-developed, typical, thick shell and a coiled embryo. The vulva and anus were situated at 1.93 and 0.22 mm., respectively, from the bluntly rounded tip of the narrowed tail. The dimensions agree closely with those given by Baylis (1925, 362) and other investigators.

The relationships of the genus have not yet been settled. Originally placed in the Filariidae, Hall (1916, 190) transferred it to a new subfamily, Gongyloneminae, belonging to the Spiruridae. This classification is that accepted by Yorke and Maplestone (1926, 312), Cram (1927), Rauther (1930), and Sprehn (1932). Nicoll in 1927 emended the name to Gongylonematinae. Baylis and Daubney (1926, 217) considered the subfamily was unnecessary and placed the genus under Arduenninae. Baylis (1929, 233) mentioned that the genus showed certain affinities with the latter subfamily. Chitwood and Wehr (1932, 168; 1934,

313) regarded the Gongylonematinae as a valid group but placed it under Thelaziidae.

Some authors quote the type species as *G. minimum* Molin; others regard it as *G. musculi* (Rud.) Neumann. The former group includes Ransom, 1911; Yorke and Maplestone, 1926; Sambon, 1926; Cram, 1927; Rauther, 1930; Chitwood and Wehr, 1934; and Sprehn, 1932. The latter group comprises Neumann, 1894; Hall, 1916; and Baylis and Daubney, 1926. Since Rudolphi (1819) did not describe his *Filaria musculi* but merely mentioned its presence in the stomach and liver of the mouse and listed it as a doubtful species, several authors have regarded it as a *nomen nudum*. Because Molin placed it as a synonym of his own name, it seems best to consider it validated by such action, so that the type of the genus would be *G. musculi*, as described by Molin. It has been suggested that Rudolphi's specimen from the liver may have been *Hepaticola* Hall (1916); Sambon (1926, 251-2, 261, 264).

The anatomy of *G. pulchrum* has been described by Stiles (1892) under *Myzomimus scutatus*; Neumann (1894), Ransom (1911, 100) and Seurat (1916) under *G. scutatum*; Chapin (1922) and Hall (1924, 120) under *G. ransomi*; Baylis (1925, 47-51) and Hall (1924, 118) under *G. pulchrum*. A summary, usually accompanied by figures, has been given under either *G. scutatum* or *G. pulchrum*, by various workers, including Brumpt (1922), Baylis (1929), Faust (1930), Sprehn (1932), and Neumann (1905). Tabulated measurements of *G. scutatum*, *G. ransomi*, *G. pulchrum*, and *G. neoplasticum* were published by Baylis (1925, 72-74). The recent treatises on the parasites of domesticated animals, by Mönnig (1934) and Cameron (1934), and those of pigs by Hall (1933), are not yet available in Adelaide.

The life history of *G. scutatum* was investigated by Ransom and Hall (1915), who found that a number of species of dung beetles (*Aphodius*; *Onthophagus*) were suitable intermediate hosts in the United States, the larval stage of the worm being found in the body cavity of the adult and larval stages of these insects. The cockroach, *Ectobia germanica*, was also proved to be able to serve as an intermediate host, eggs of *Gongylonema* from cattle and from pigs having been used for the experimental infections. Attempts to infect a pig with larvae of ruminant origin, the cockroach being used as the intermediary, failed, this failure being regarded as supporting the view that the pig parasite is specifically distinct from that occurring in sheep and cattle. Sheep were infected experimentally by larvae from a cockroach, but developed from worms from cattle. About three months elapsed between infection and maturity in the sheep. Attempts to infect a rabbit and a guinea pig failed. A period of about a month was required to complete the larval stages in the cockroach. These authors showed that the life history was similar to that made known for *G. neoplasticum* of rats, by Fibiger and Ditlevsen (1914), who reported that three species of cockroaches (*Periplaneta americana*, *P. orientalis*, *Ectobia germanica*) as well as the meal worm, *Tenebrio molitor*, could serve as intermediaries, while the adult stage could be developed in the two common rats, *Epimys norvegicus* and *E. rattus*, as well as in the mouse, rabbit and guinea pig.

Seurat (1916) thought that some of the larvae from coprophagous beetles, described by Ransom and Hall (1915) as *G. scutatum*, belonged to another species, but these latter authors (1917) brought forward evidence to support their earlier contentions and stated that the larvae which Seurat regarded as those of *G. scutatum* belonged to some other *Gongylonema*.

Baylis, Pane and Sambon (1925) were successful in transmitting *G. pulchrum* of ruminants to rats. They reported the parasite to be common in cattle in parts of Italy, and obtained the larval stages from four species of coprophagous beetles, but cockroaches were not found to be infected naturally. One species of the

latter, *Blattella germanica*, could be readily infected artificially, but these authors failed with *Blatta orientalis*. They published figures of the insect hosts and of the larval parasites. Blair (1925; 1926) referred to the finding of these larvae in the following scavenging beetles in Italy—two species of *Onthophagus*, and one each of *Caccobius*, *Aphodius* and *Oniticellus*. Sambon (1926, 257-61) mentioned these coleopterous hosts as well as the cockroach, *Blattella germanica*, and published figures of them as well as of the larvae found in them. Baylis had stated previously (1925) that *G. scutatatum*, amongst others, was a synonym of *G. pulchrum* and had suggested (1925, 75) that *G. neoplasticum* might also belong to the same species. This view was controverted by Leiper (1926, 56; 1926, 70), who published two papers in 1926, adversely criticising the views of Sambon (1925) regarding *Gongyylonema* as a possible cause of cancer in humans, and those of Baylis (1925) relating to the synonymy of *G. pulchrum*. Leiper considered the latter, *G. scutatatum* and *G. neoplasticum* as distinct species. He found the last-named in rats and, as larvae, in cockroaches (*Periplaneta americana*) in the London Zoological Gardens. Material from bisected cockroaches was fed, one half to laboratory bred rats, and the other half to lambs, both groups of animals becoming infected, but the measurements of the adult worms were those of *G. neoplasticum*. He stated that, though his parasite could under experimental conditions be developed in sheep, in that abnormal host is retained the morphology characteristic of it in its normal host, and consequently was not a synonym of *G. scutatatum*.

Leiper's criticism was replied to by Sambon (1926, 314) and by Baylis (1926, 503) who maintained their previous views as to the identity of *G. pulchrum* and *G. scutatatum*, though *G. neoplasticum* was admitted to differ in one particular feature. Leiper (1926, 504) gave a further reply, maintaining that the three were distinct species.

Baylis, Sheather and Andrews (1926, 194) carried out investigations regarding the life history, using dung beetles, the cockroach (*Blattella germanica*), and *Gongyylonema* from cattle. They were able to transmit it to cattle and to sheep but not to pigs, but no morphological differences between worms from pigs and from ruminants could be detected. Adult worms were found in a calf and in sheep twenty weeks after infection. The same authors a little later (1926, 346) announced that they had succeeded in infecting pigs by using *Blattella germanica* and *Gongyylonema* derived from cattle. *G. ransomi*, described by Chapin from American pigs, was added to the synonymy. It was stated that perhaps pigs and human beings were only accidental hosts of the species which normally inhabited the mucosa of the oesophagus of ruminants, whereas in the other hosts it occurred in the mucosa of the mouth and tongue rather than the oesophagus. Infective larvae were found to emerge spontaneously from their insect intermediate hosts when the latter were killed and placed in water. Since they are able to live some days in water, the latter must be regarded as a possible source through which final hosts may become infected. Blair (1926, 297) referred to the rupture of the cyst wall enclosing the larva when in contact with water, thus permitting escape.

Stiles and Baker (1927, 67) were able to transfer *G. scutatatum* of cattle to white rats (*Rattus norvegicus albus*) through *Blattella germanica*, there being a light infestation in the oesophagus of only a few of the experimental rodents, and no trace of cancer such as is found associated with the rat parasite, *G. neoplasticum*, was caused.

Schwartz and Lucker (1931, 46) utilized worms from sheep, infected cockroaches and then succeeded in infecting pigs. Lucker (1932, 135) found that 106 days were necessary for *Gongyylonema* to reach maturity in the pig, the eggs having been derived from sheep and cattle, and the larval stages passed through cockroaches. The period required was much greater than that reported by Baylis,

Pane and Sambon (1925) for ruminant *Gongylonema* to attain maturity in rats. Lucker re-examined Chapin's material of *G. ransomi* and confirmed Baylis' opinion (1925, 75) that it, together with *G. scutatum*, was a synonym of *G. pulchrum*. Mature specimens of ruminant origin, developed experimentally in white rats, guinea pigs and rabbits, were found to be indistinguishable from *G. pulchrum*, which was fairly common in pigs in U.S.A. Alicata (1934, 51), published some observations on the development to maturity in the guinea pig.

G. pulchrum in its structure and life history closely resembles *G. neoplasticum*, which appears to be a distinct species infesting rats and mice. The latter was first known from Denmark and the Danish West Indies (Fibiger, 1913; Fibiger and Ditlevsen 1914) and has been found subsequently in Holland and Surinam by Wassink (1916, 1,108) and Baylis (1925, 316); in London by Leiper (1926); in Formosa (var. *orientale*) by Yokogawa (1925); in U.S.A. by Lucker (1931); and in Russian Asia by Sassuchin, Tiflow and Schulz (1935, 656). Its larval stages can be passed in the cockroaches *Blatta orientalis*, *Periplaneta americana* and *Ectobia* (or *Blattella*) *germanica*, as well as in the meal worm, *Tenebrio molitor*. Yokogawa (1925) reported that the larvae of *G. orientale* occurred in the muscles of *Periplaneta americana* and *P. australasiae*. *G. neoplasticum* and *G. orientale* differ from *G. pulchrum* in their pathological effects, as they may give rise to neoplasms, Fibiger (1913; 1920), Wassink (1916) and Yokogawa (1925) having paid particular attention to this subject.

Hall (1924, 122-3) mentioned the use in meat inspection of pigs in U.S.A. of a scratching apparatus consisting of a wooden skewer from the conical end of which a bent pin projected less than one-quarter inch. The instrument is pulled across the tongue to make a series of shallow furrows in the dorsal mucosa between the papillae at the root of the organ and a line drawn across it, two or three inches in front of the vallate papillae. Worms, if present, are pulled out and recognised. Lucker stated that examination for the presence of this parasite in pigs' tongues is now part of the routine of meat inspection in U.S.A.

Sambon published figures showing abundance of the worms *in situ* in the oesophagus of Italian sheep (1925, 71) and cattle (1926, 257).

Railliet (1893, 541) suggested that *G. scutatum* might be a synonym of *G. pulchrum*, and Neumann recognised the close relationship between the two. The latter author (1894) attributed a very imperfectly known form, *Spiroptera ursi* Duj 1845, to the genus, and this together with some of Molin's species (*filiforme* and *spirale*) was subsequently considered by Baylis (1925) as probable synonyms of *G. pulchrum*. It should be remarked that the three species of Molin described in 1857, and just referred to, have page precedence as follows:—*G. filiforme* (p. 220), *spirale* (p. 222) and *pulchrum* (p. 223); hence if they are synonyms, *G. filiforme* has precedence. *G. spirale* was obtained from a deer, *Cervus dama*, and is probably synonymous with *G. pulchrum*. *G. filiforme* will be referred to later.

Baylis (1925) considered that *G. ursi* (Duj.) was a probable synonym. This species, described by Dujardin (1845) as a *Spiroptera*, was a renaming of *Sp. ursi-arcti* Rudolphi (1819, 253). The latter author referred to it also as *Sp. ursi* and *Strongylus ursi* (p. 28) and placed it amongst the doubtful species. His brief account is based on that of Bremscr who examined four worms 12-14 lines long from the oesophagus of a brown bear, not a polar bear as stated in several parasitological articles. Stiles and Hassall, in the Index Catalogue (1926), indicate that Rudolphi's name was based on *Taenia ursi* Gmelin 1790, and was attributed by him in 1809 to *Strongylus*, Diecising in 1851 transferring it to *Nematoideum*. It seems obvious that the parasite is quite unrecognisable and the name had best be treated as a nomen nudum, otherwise the name *ursi* must take precedence over all the others associated with *G. pulchrum*, if they are synonym-

ous. Sambon (1925, 315) also referred to *G. ursi*.⁽¹⁾ In 1860 Molin described *contortum* from the same host species, *Ursus arctos*, Cobbold (1879, 297) calling it *Spiroptera (Gongylonema) contorta*. In 1894 Neumann (1894, 473) regarded it as a synonym of *G. ursi* which he transferred to *Gongylonema*, and this opinion was supported by Stossich (1897, 133), but the latter retained Molin's name. Faust (1930, 421) accepted *G. ursi* as a synonym of *G. pulchrum*. Baylis (1929) and Sprehn (1932) did not refer to *G. ursi* in their lists of synonyms.

G. confusum Sonsino (1896) from a horse in Egypt, was regarded by Seurat (1916, 726) as synonymous with *pulchrum*, and this opinion is accepted by later authors.

G. pulchrum of Seurat (1912, 1914—not 1916) from a hedgehog in Algeria, is a distinct species, subsequently described by that author (1916) as *G. mucronatum*.

The following is a list of the synonyms of *G. pulchrum* Molin 1857:—*Spiroptera scutata oesophagea bovis* Müller, 1869; *Filaria scutata* Leuckart, 1873; *Spiroptera scutata*; *Gongylonema scutata* Railliet, 1892; *G. confusum* Sonsino, 1896; *G. ransomi* Chapin, 1922; *Filaria labialis* Pane, 1864; *Agamofilaria labialis* Castellani and Chalmers, 1913; *G. labiale* Yorke and Maplestone, 1926; *G. subtile* Alessandrini, 1914; *G. hominis* Stiles, 1921; *Myzomimus scutatus* Stiles, 1892.

The following may perhaps be synonymous with *G. pulchrum*:—*Strongylus ursi* Rud., 1809; *Spiroptera ursi* Rud., 1819; *G. contortum* Molin, 1860; *Spiroptera contorta* Cobbold, 1879; *Spiroptera ursi-arcti* Rud., 1819; *Spiroptera ursi* Duj., 1845; *G. filiforme* Molin, 1857 (in part), and other species from monkeys, referred to later; and *G. spirale* Molin, 1857. The last-named was taken from a deer and, since undoubted specimens of *G. pulchrum* have been recognised from other deer by Baylis (1925) and Lucker (1933), Baylis was most probably correct in adding it to the synonymy, but the name has page priority over *G. pulchrum*.

The parasite is known from a wide range of hosts, though it occurs more commonly in the domestic ruminants, especially sheep and cattle. To this list are to be added goats, zebu, and buffalo; as well as the deer, *Dama dama* (by Molin, 1857); chevrotain, *Tragulus* sp. (by Baylis, 1925); and mule deer *Odocoileus hemionis* (by Lucker, 1933, 249). The pig not uncommonly serves as a host, and the parasite has been reported from the wild boar. Occasional hosts are man, certain monkeys, horse, ass and dromedary. Baylis and Daubney (1923, 569) reported it from the ox; *Bos bubalus*; and the Karkar sheep or ural, *Ovis vignerii*, from India. Perhaps the brown bear may serve as a host.

It has been carried through to maturity (by experimental infections with larvae) in the rat (*Epimys norvegicus albus*), rabbit and guinea pig.

The larval stages are passed through in various species of dung beetles belonging to the genera *Onthophagus*, *Aphodius*, *Caccobius* and *Omiticellus*, as well as in the cockroach, *Blattella germanica*.

G. pulchrum is now known from various European localities, having been reported more frequently from the warmer southern portions, more particularly Italy and France (Railliet; Neumann). Alessandrini (1908), Sambon (1925, 66; 1926), Baylis (1925, 71) and Sebastiano (1926) referred to its abundance in Italian sheep and cattle. Raffaelli (1925) reported it as occurring in 20% of oxen, 70% of sheep and 0.3% of pigs slaughtered at Ravenna. Baylis (1925, 73) mentioned its presence in domesticated buffaloes in Italy. Sambon (1925, 316) reported it from oxen in Holland.

⁽¹⁾ It is of interest to note that Inukai and Yamashita (Trans. Sapporo Nat. Hist. Soc., vol. xiii, 1934, p. 324-5) have recorded the occurrence in the Japanese variety of the brown bear, *Ursus arctos yesoensis*, of a nematode, *Ascaris lumbricoides*, whose common hosts are human beings and pigs.

It has been recorded by several observers from the United States:—Stiles (1892), Ransom (1911), Hall (1924), Chapin (1922), Lucker (1932), and others. Other localities are India, China (Schwartz, 1926) and Victoria (Sweet, 1909). Additional Australian localities are mentioned at the end of this paper.

The species of *Gongylonema* from primates other than man may be referred to. Seurat (1916) mentioned *Macacus sinicus* and *M. sylvanus* (i.e., *inuus*) as hosts. Lucker (1933, 248) recorded it from the spider monkeys *Ateles* sp. and *Cebus capucinus*. Stiles, Hassall and Nolan (1929, 468), in their catalogue of parasites reported for primates, mentioned two species of *Gongylonema*, viz.: *G. pulchrum* from man and the two monkeys *Macacus sylvanus* (*inuus*) and *Silenus sinicus*; and *G. filiforme* from the former. The latter parasite was named by Molin (1857) to replace *Filaria gracilis simiae-inui*, but Linstow (1899) Stossich (1897), as well as Yorke and Maplestone (1926), regarded it as a synonym of *Dipetalonema gracile* Dies. Baylis (1925) suggested that it was a synonym of *G. pulchrum*. Van Thiel (1925) considered it a valid species of *Gongylonema*, as also did Lucker (1933, 248), the latter stating that the only host now definitely known to harbour *G. filiforme*, was *Macacus inuus*. Lubimov (1931, 446) reported a new species, *G. macrogubernaculum*, from the oesophagus or bronchi of three monkeys, *Macacus rhesus*, *Cebus hypoleucus*, and *Cercopithecus tamapsin* (? = talapoin) from the Zoological Park, Moscow; Lucker (1933, 243) recording it from *Macacus lasiotis* and *Papio rhodesiae*, both from Zoological Gardens in U.S.A. Gebauer (1933, 730) described *G. microgubernaculum* from the oesophagus and bronchi of *Silenus rhesus*. In view of the known variability of *G. pulchrum* and its capability to parasitise primates, as well as the fact that dung beetles and cockroaches serve as its intermediate host and would have access to infective material from ruminants, etc., housed in zoological gardens and could be eaten by monkeys lodged there, it is suggested that these species, especially *G. macrogubernaculum* and *G. microgubernaculum*, may be synonyms of *G. pulchrum*. Van Thiel (1925, 176) described a nematode, *Squamema bonnei* from a South American monkey *Alouatta seniculus*, which he placed in the Gongylo-neminae, but Yorke and Maplestone (1926, 315), as well as Baylis and Daubney (1926, 212), considered the genus as close to *Parabronema*, which is placed in a different subfamily of the Spiruridae, while Chitwood and Wehr (1934, 319) regarded it as a synonym of *Parabronema* (Habronematinae). In his account of *G. saimirisi* from a Brazilian monkey, Artigas (1933) discussed the possibility of it becoming a human parasite.

Three species of *Gongylonema* have been recorded as occurring in Australia, viz.: *G. scutatum* by Sweet (1909, 523) from a cow in Victoria; *G. ingluvicola* Ransom by Johnston (1918, 215) from the proventriculus of a fowl in Sydney, and *Gongylonema* sp. by Johnston (1918, 61) from the liver of a mouse and of a white rat in Sydney.

G. pulchrum (syn. *G. scutatum*) occurs occasionally in cattle in Queensland, and I have seen specimens from the same host from Sydney and Adelaide abattoirs. It has not yet been identified from sheep, pigs or goats in Australia. Kauzal (1930) makes no reference to it in his list of parasites known to occur in pigs in New South Wales, nor does Roberts (1934) in his list of those reported from domesticated animals in Queensland. *G. ingluvicola* occurs in North Queensland, as I have received material taken from chickens in Mackay. *Gongylonema* sp. from rodents was probably *G. neoplasticum*.

Cleland (1918, 119-120), in referring to the carcinogenic effects attributed to the latter species, suggested that in a case of very heavy infestation of the stomach of a rat, *Epimys norvegicus*, in Western Australia, by nematodes recorded by him in 1912 as *Protospirura muris*, the parasite may perhaps have been *G. neoplasticum*, since pathological changes were present in the stomach wall.

He stated that sections of the stomach of an apparently normal rat revealed portions of a nematode embedded in keratinised squamous epithelium. The worms taken from the lumen were examined by me and were undoubtedly *P. muris*, while those represented in the sections were probably *Gongylonema*, though *Capillaria* (or *Hepaticola*) *gastrica* Baylis is a possibility, Bonne, in 1926, having described a cancerous condition of the gastric mucosa associated with that species in the rat.

SUMMARY.

A review is made of the occurrence of *Gongylonema pulchrum* in man and various other animals, its life history, synonymy and distribution. Records of the occurrence of the genus in Australia are given.

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